DEPARTMENT OF NATIONAL DEFENCE
CANADA

OPERATIONAL RESEARCH DIVISION

DIRECTORATE OF OPERATIONAL RESEARCH (JOINT & LAND)

DOR(J&L) RESEARCH NOTE RN 9803

AN EVALUATION OF LOGISTICS PLANNING TOOLS

BY

Michel Vigneault
Major Doug Hoyle

FEBRUARY 1998

OTTAWA, CANADA

National Defence Défense nationale

OPERATIONAL RESEARCH DIVISION

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102-02478/

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OTTAWA, ONTARIO FEBRUARY 1998

ABSTRACT

In March 1997, J4 Log tasked LOGORT to conduct an evaluation of two software systems being considered as potential logistics planning tools for the Canadian Forces. This paper presents a multi-criteria methodology for evaluating logistics planning software. It proposes a list of criteria to be considered through a two-stage process involving first a technical evaluation and secondly a user evaluation. During each step, a subset of criteria are evaluated using the judgements of evaluators, in order to produce satisfaction ratings. This report presents results of the technical evaluation and makes recommendations concerning a user evaluation.

RÉSUMÉ

En mars 1997, J4 Log a demandé à ÉROL d'évaluer deux logiciels de planification logistique pour les Forces canadiennes. Ce document présente une méthodologie multi-critère pour évaluer les logiciels de planification logistique. Il propose une liste de critères à considérer dans un processus impliquant premièrement une évaluation technique et deuxièmement une évaluation par les usagers. Durant chaque étape, un sous-ensemble de critères est évalué d'après le jugement d'évaluateurs, afin de produire des indices des satisfaction. Ce rapport présente les résultats de l'évaluation technique et énonce des recommendations concernant l'évaluation par les usagers.

EXECUTIVE SUMMARY

Although the need for an automated logistics planning tool has been recognized in the field for a while, several events in the fall of 1996 brought the issue to the attention of the logistics staff at National Defence Headquarters. First, CANLOG Planner, a Canadianized version of the U.S. planning tool OPLOG Planner, was adapted for use by 1 Canadian Division at Kingston. Secondly, the Netherlands research organization TNO offered to Canada their logistics planning tool Planlog as part of a bilateral collaboration agreement. In addition, other logistics software initiatives were identified. The overlap and lack of coordination between these software initiatives became an obvious problem which needed to be addressed. In the spring of 1997, J4 Log tasked LOGORT to define a formal evaluation methodology for logistics planning tools and apply the methodology to the two tools mentioned earlier.

The evaluation methodology was developed as a two step process. Stage one is a review, by technical evaluators, of the logistics planning tool. The technical strengths and weaknesses of the programs are quantified against benefit, cost, and risk criteria. A satisfactory technical evaluation of the tool enables the second step of the evaluation process, a user evaluation. The user evaluation is conducted to investigate user-related aspects of the tool. Prospective users of the tool evaluate practicality and employability criteria. Upon completion of both stages of the evaluation process, a thorough understanding of the tool is derived. A criteria weighting structure is employed to derive an overall rating for the tool. This allows comparison of the evaluation results for different software tools. The results of the technical evaluation of Planlog and CANLOG Planner along with a comparison of these results are presented in this document.

The technical evaluation of Planlog and CANLOG Planner was conducted in the following manner. The members of the technical evaluation team each reviewed one of the tools under consideration in isolation, using pre-defined criteria. They attributed numerical scores according to a previously defined scale and provided comments concerning each criteria. The technical evaluation results were then compared to ensure consistency.

Six benefit criteria were evaluated. There was little or no difference in the scores attributed to the two tools for the Completeness, Doctrinal fit, Quality of Results and

Supportability criteria. For the Data Maintainability criteria, both tools obtained an unsatisfactory rating, mostly because of the lack of validation of the staff data employed. Planlog was rated slightly better than CANLOG Planner because its data is easy to amend. For the Growth Potential criteria, CANLOG Planner was rated slightly unsatisfactory because it would require a complete rewrite prior to enhancement. For the same criteria, Planlog was rated very satisfactory due to its flexible programming technology and forecasted growth.

Four cost criteria were evaluated. Both tools received ratings on the favourable side, due mostly to the fact that costs were either already incurred, or were to be shared as part of the collaboration agreements with the U.S. or the Netherlands.

Three risk criteria were evaluated. This area is where the largest differences between the two tools lie. For the Risk of Senior Management Support criteria, CANLOG Planner was favourably rated because it has already been accepted in DoD and by some Senior Management in DND, while Planlog was not favourably rated because it is still at the prototype stage and has not been yet fielded. For the Risk of User Acceptance and Risk of Obsolescence criteria, Planlog was favourably rated because of its modern, user friendly and intuitive features while CANLOG Planner was unfavourably rated because of its older, procedurally dependant interface.

The preceding discussion of results was in very general terms. For a more precise treatment, refer to Annex A for the technical evaluation of CANLOG Planner or Annex B for Planlog's. The main text also includes a summary of findings. These results should not be taken in isolation as an indication of the suitability of either tool - the user evaluation results are a key part of the process. However there is sufficient evidence that a user evaluation of Planlog is warranted. CANLOG Planner has already been fielded, so user input can be obtained without necessarily conducting a formal user evaluation.

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AN EVALUATION OF LOGISTICS PLANNING TOOLS

BACKGROUND

1. In March 1997, LOGORT was tasked by J4 Log to conduct an evaluation of two logistics planning tools (Ref. 1, 2). This Software evaluation project was a result of several independent events during the fall of 1996 which brought to the attention of logistics staff at National Defence Headquarters the requirement to evaluate logistics planning tools. The first event was the development of CANLOG Planner, a Canadianized version of a US logistics planning tool OPLOG Planner. CANLOG Planner was adapted for Canadian use by 1 Canadian Division Headquarters at Kingston. Secondly, the Netherlands research organization TNO offered to Canada their tool Planlog as part of a bilateral collaboration agreement. In addition, several other logistics software initiatives were identified. The overlap and lack of coordination between these software initiatives became an obvious problem which needed to be addressed. The Software Evaluation Project was started to define a reusable evaluation methodology to deal with logistics planning tools for the Canadian Forces. The methodology was to be applied first to the two tools mentioned earlier.

OBJECTIVES

2. Logistics planning encompasses a wide variety of functions such as consumption planning, distribution planning, and maintenance planning. Not surprisingly, tools that perform logistics planning may be very different from one another. Indeed the two logistics planning tools currently under consideration in Canada work very differently. This condition makes comparison of different logistics planning tools very difficult. The solution to this dilemma is to understand the strengths and weaknesses of the tools as well as how important these characteristics are to the logistics planning process. The general objective of this project is *to determine which tool is most suitable as a logistics planning tool for Canada.* This broad objective implies that all reasonable candidate software packages will be evaluated in an objective and comprehensive manner. Currently, only two software tools are being considered. However, to satisfy the primary objective, we may eventually have to consider

a number of other logistics software tools. For this reason, we have adopted a sub-objective to *develop a baseline evaluation plan for future software systems.*

SCOPE

3. The methodology described in this document has been derived so that it can be reused to evaluate other logistics software tools as they are identified. The mature version of this methodology will be employable by logistics experts without operational research support. The report explains the evaluation methodology and the results of the technical evaluation of the CANLOG Planner and Planlog tools. It does not contain final recommendations concerning the two logistics planning tools.

EVALUATION PROCESS

4. In order to assess software, evaluation criteria are required. The evaluation criteria for this methodology are based upon the expert opinion of logistics practitioners and operational research analysts. A set of 28 evaluation criteria has been developed. They can be grouped into five categories; Costs, Benefits, Risks, Practicality, and Employability. Unfortunately, all criteria categories cannot be adequately evaluated by the same people. The first three criteria categories are suited to evaluation by a technically competent evaluation team. The final two criteria categories are of a functional nature and their evaluation required the attention of potential users of logistics planning tools.

5. The requirement for different evaluation teams suggests a two step evaluation process. The technical evaluation should precede the user evaluation. It should evaluate the technical characteristics of the tool to reveal its strengths and weaknesses. If the technical evaluation reveals a critical deficiency in any of the tools, the tool can be rejected and the user evaluation may then be cancelled for that tool.

6. Upon successful completion of a technical evaluation, criteria of a more functional nature can be assessed by potential users. Test cases consisting of inputs, expected results and evaluation criteria must be established for the purpose of exposing users to the software. After some initial training, selected users must test the software systems. Employing their knowledge of logistics planning, they report their level of satisfaction with the tool using

evaluation criteria. Evaluators provide a numerical rating for each criteria they assess and they are also encouraged to provide comments.

EVALUATION METHODOLOGY

7. In order to correctly interpret the satisfaction ratings acquired from the technical and user evaluations of logistics planning tools, it is important that the relative importance of the evaluation criteria be understood. In order to acquire these criteria importance ratings, a one time survey of the primary stakeholders in the logistics community is required. Evaluation tables soliciting indications of the level of importance of each evaluation criteria are completed by representatives from each of the environmental chiefs of staff, CFSAL, CFCSC, and J4 Log representatives. Special care is taken to ensure that ratings are obtained as objectively as possible. An evaluation table for the importance ratings is shown in Table I. Definitions for each criteria and evaluation principles are given with the evaluation instructions. This information is combined to form a baseline evaluation criteria weighting structure. This structure is approved by the project sponsor before the comparison of software options is completed.

8. The ratings being requested from respondents are representative of their attitudes. Importance ratings record how much importance stakeholders give to a criteria while satisfaction ratings record how satisfied the evaluators are with the system being evaluated. Responses can be conveniently recorded by picking a number within a range, with the smallest number representing total lack of satisfaction/importance and the highest number representing the highest level of satisfaction/importance. A scale of one to nine is used because it contains enough gradations to differentiate the potential attitudes, without overwhelming the respondent. Such a scale representing the level of importance/satisfaction contains the following levels:

a. totally unimportant/unsatisfactory (1)

b. very unimportant/unsatisfactory (2)

c. unimportant/unsatisfactory (3)

d. mildly unimportant/unsatisfactory (4)

e. neither unimportant/unsatisfactory nor important/satisfactory (5)

f. mildly important/satisfactory (6)

g. important/satisfactory (7)

h. very important/satisfactory (8)

j. totally important/satisfactory (9)

9. The importance ratings collected from logistics stakeholders will be used to generate weights for each criteria. The weighting scheme is normally determined by the decision-maker, taking into account the needs of the potential users. Therefore the weights obtained from the stakeholders will be submitted for review to the sponsor, who will have an opportunity to confirm or modify the rating scheme.

10 The user evaluations will likely result in multiple importance ratings for each criteria, reflecting the diversity of the attitudes of the respondents. Differences between respondents will be analysed using graphical methods to highlight the range of responses. First and second moments will be used to quantify the differences between respondents. Differences between software systems will also be analysed using graphical methods. A final score consisting of the weighted sum of mean satisfaction ratings will be obtained for each software tool. Satisfaction intervals will also be generated using the weighted sum of minimum ratings and the weighted sum of maximum ratings.

TABLE I

EVALUATION TABLE FOR IMPORTANCE RATINGS

CRITERIA	IMPORTANCE RATING (Check one) NOT IMPORTANT 1	2	3	4	5	6	7	8	VERY IMPORTANT 9	COMMENT
Cost of development										
- of acquisition										
- of training										
- of O&M										
User friendliness										
Learning curve										
Data maintainability										
Relevance of output										
User-confidence in output										
Growth potential										
Completeness										
Data sharing										
Doctrinal fit										
Quality of results										
Supportability										
Employability in army										
- in air force										
- in maritime forces										
- in joint forces										
Employability for OOTW										
- for crisis/war										
Employability for what-if scenario analysis										
- during pre-deployment										
- during deployment										
- during employment										
Risk of senior management support										
- of user acceptance										
- of obsolescence										

TECHNICAL EVALUATION:

12. The technical evaluation team will make judgements concerning the level of satisfaction with respect to the technical criteria. A general understanding of the criteria and the corresponding satisfaction levels are given in the following sections. In many cases, satisfaction levels have been defined by setting a baseline level at one end of the satisfaction spectrum and adjusting other levels relatively to that baseline. In most cases, objective definitions are not possible or suitable.

13. **Cost of development** refers to the unspent cost of research and development required to build a Canadian version of the software. A satisfactory cost depends on the budget available, which changes over time. As a baseline, we set a nil or negligible cost as a highly satisfactory level, then assess higher costs using the assumption that costs clearly below a reasonable budget level would be satisfactory and costs clearly beyond a reasonable budget level would be unsatisfactory. In the absence of a reasonable budget level, satisfaction levels can be assessed by comparing the expected R&D costs relatively to each other.

14. **Cost of acquisition** refers to the cost of purchasing the hardware and software required to operate the system. Again, we set a nil or negligible cost as a highly satisfactory level, then assess higher costs relatively to each other, with the assumption that a cost clearly below a reasonable budget level would be satisfactory and a cost clearly beyond a reasonable budget level would be unsatisfactory.

15. **Cost of training** refers to the cost of training the personnel required to operate and maintain the system. An evaluation of the training requirements for each software tool will have to be made. A highly satisfactory rating would be given to a tool which uses standards common to other tools and which the users can start operating with little or no training. An unsatisfactory rating would be given to a software tool which requires users to undergo extensive training before being able to operate or maintain the tool. Satisfaction levels can be assessed by comparing the training costs relatively to each other.

16. **Cost of O&M** refers to the cost of operating and maintaining the system. A highly satisfactory rating would be given to a tool which requires nil or negligible O&M cost. An unsatisfactory rating would be given to a tool which likely requires an extensive amount of

O&M cost. Satisfaction levels can be assessed by comparing the O&M costs relatively to each other.

17. **Data maintainability** refers to the degree to which the data employed by a tool can be maintained with ease. A highly satisfactory level for data maintainability would be that the data could be updated regularly from existing sources, with minimal manipulations. A satisfactory level would be that the data could be updated regularly, with a reasonable investment of effort. A highly unsatisfactory level would be that the data could only be updated irregularly, and only through an unreasonable investment of effort.

18. **Growth potential** refers to the degree to which the system can be expanded, either by improving the existing functionality, or by extending the functionality of the system. A highly satisfactory level would be that the system could be expanded easily. An unsatisfactory level would be that improving or adding functionality would require a large investment of effort or resources.

19. **Completeness** refers to the degree to which the software system performs the full range of logistics planning tasks. The required tasks are not at this point cast in stone, but they generally include determining the logistics requirement, planning for its delivery and tracking the support process. A highly unsatisfactory rating would be given to a software tool which performs no task suitably. A satisfactory rating would be given in cases where the software system performs a broad range of logistics planning tasks.

20. **Doctrinal fit** refers to the degree to which the model corresponds to the doctrine of the Canadian Forces. A highly satisfactory rating would be given in the case of a planning tool that accommodates all aspects of logistics doctrine correctly. A satisfactory rating could be given if a minor aspect of logistics doctrine was incorrectly accommodated. An unsatisfactory rating could be given to a tool which accommodates incorrectly an important aspect of logistics doctrine.

21. **Quality of results** refers to the degree to which the results are precise and accurate. A highly satisfactory rating would be given to a planning tool for which all results are deemed to be precise and accurate. An unsatisfactory rating would be given to a planning tool for which key results are incorrectly or inaccurately derived.

22. **Supportability** refers to the level of support which the developer may be able to give for the software tool in the future. A highly satisfactory rating would be given to a software tool which has a well established and readily accessible developer. An unsatisfactory rating would be given to a tool for which developer support is likely to be difficult to obtain.

23. **Risk of senior management support** refers to the risk that senior management will not support the software tool. A highly satisfactory rating would be given to a software tool which has been used in a defence environment and has gained the support of senior management in that environment. An unsatisfactory rating would be given to a software tool which has not been accepted by any senior management or is not likely to be accepted by DND's senior management.

24. **Risk of user acceptance** refers to the risk that the users may not accept the software tool. A highly satisfactory rating would be given to a software tool which is known to have a favourable reputation among its current users. An unsatisfactory rating would be given to a software tool which has a significant risk of not being accepted by its users.

25. **Risk of obsolescence** refers to the risk that technological advancement could render the system obsolete. A system can be rendered obsolete due to technology changes or when a better system replicates its functionality. A highly satisfactory rating would be given to a software tool that has been developed to accommodate current technology and which has no known competitor likely to render it obsolete. An unsatisfactory rating would be given to a tool which has a significant likelihood of becoming obsolete in the near or medium term.

26. Each member of the technical evaluation will be assigned one tool to evaluate according to the above principles. These initial evaluations will be performed separately but will be followed by a team wrap-up to discuss findings and to ensure that consistent assumptions were employed. A narrative will be provided to explain the ratings given for each tool.

USER EVALUATIONS

27. In addition to evaluating technical criteria, the proposed methodology includes an evaluation by the users of a logistics planning tool. The user evaluation aims to examine mainly the functional characteristics of the models. Users will make judgements concerning

the level of satisfaction with the functional criteria. A general explanation of the criteria and guidelines for the corresponding satisfaction levels are provided in the following paragraphs. Satisfaction levels have been defined by setting a baseline level at one end of the satisfaction spectrum and adjusting other levels relatively to that baseline. Definitions are chosen to be as objective as possible.

28. Two kinds of functional criteria are evaluated: practicality criteria and employability criteria. Practicality criteria refer to the degree to which the software tools conform to the practical needs of users of logistics planning tools. The five criteria are: user friendliness, learning curve, relevance of output, user-confidence in output and data sharing.

29. **User friendliness** refers to the degree to which the software system incorporates features which make it user-friendly for its users, that is the degree that the software tool responds to users in a way that they feel is pleasant. A highly unsatisfactory rating should be given to a system that includes ongoing irritants that make it difficult to understand and to use. A system which is easy to understand and to use should be given a satisfactory rating.

30. **Learning curve** refers to the time and effort required to understand the system and to use it productively. A highly satisfactory rating should be given to a system which can be understood and which produces results immediately as it is being used, without the need for initial training. An unsatisfactory rating should be given to a system which requires a long learning period before it can be understood or used.

31. **Relevance of output** refers to degree to which the output is relevant to the logistics planning process. The logistics planning process includes the determination of the logistics requirement, the planning for its delivery and the tracking of the support process. The complexity of the output, for example, should be appropriate for the task for which the output is being used. A highly unsatisfactory rating should be given to a tool which produces output which is not relevant for the logistics planning process. A satisfactory rating should be given to a software tool which produces output which is mostly relevant and does not omit key relevant output.

32. **User-confidence in output** refers to the degree to which the user has confidence in the output. This criteria concerns the way the results are presented: whether the user can track the reasons for a particular output. A highly satisfactory rating means that the results

are presented in a way that inspires confidence in the output. An unsatisfactory rating means that the results are not presented in a way that inspires confidence in the output.

33. **Data sharing** refers to the degree to which data can be transferred to and from existing logistics systems such as the CFSS, ADAMS, FIS, with minimal difficulty. A highly satisfactory rating means that the software system can export the necessary data files directly into these tools, and that it can directly import the necessary files from these tools. An unsatisfactory rating means that the necessary data cannot be shared electronically with the existing logistics systems.

34. The employability criteria are a way for the users to determine what are the limits of the logistics planning tool. There are three dimensions which are considered: the service (army, air force, maritime, joint forces), the level of conflict (OOTW, crisis/war) and the planning stage (what-of scenario analysis, pre-deployment, deployment, employment).

35. **Employability in army** refers to the degree to which the software can be useful for logistics planning in the army environment. A highly unsatisfactory rating should be given to a logistics tool that has no capability for logistics planning in the army environment. A satisfactory rating should be given to a logistics tool which has most of the capability required for logistics planning in the army environment.

36. **Employability in air force** refers to the degree to which the software can be useful for logistics planning in the air force environment. A highly unsatisfactory rating should be given to a logistics tool that has no capability for logistics planning in the air force environment. A satisfactory rating should be given to a logistics tool which has most of the capability required for logistics planning in the air force environment.

37. **Employability in maritime forces** refers to the degree to which the software can be useful for logistics planning for maritime forces. A highly unsatisfactory rating should be given to a logistics tool that has no capability for logistics planning in the maritime environment. A satisfactory rating should be given to a logistics tool which has most of the capability required for logistics planning in the maritime environment.

38. **Employability in joint forces** refers to the degree to which the software can be useful for logistics planning for joint force operations. A highly unsatisfactory rating should

be given to a logistics tool that has no capability for logistics planning for joint forces. A satisfactory rating should be given to a logistics tool which has most of the capability required for logistics planning for joint forces.

39. **Employability for OOTW** refers to the degree to which the software can be useful for logistics planning in Operations Other Than War. A highly unsatisfactory rating should be given to a logistics tool that has no capability for logistics planning for OOTW. A satisfactory rating should be given to a logistics tool which has most of the capability required for logistics planning for OOTW.

40. **Employability for crisis/war** refers to the degree to which the software can be useful for logistics planning for crisis/war. A highly unsatisfactory rating should be given to a logistics tool that has no capability for logistics planning for crisis/war. A satisfactory rating should be given to a logistics tool which has most of the capability required for logistics planning for crisis/war.

41. **Employability for what-if scenario analysis** refers to the degree to which the software can be useful for logistics planning while performing what-if scenario analysis. A highly unsatisfactory rating should be given to a logistics tool that has no capability for logistics planning during the what-if scenario analysis stage. A satisfactory rating should be given to a logistics tool which has most of the capability required for logistics planning during the what-if scenario analysis stage.

42. **Employability during pre-deployment** refers to the degree to which the software can be useful for logistics planning during the pre-deployment stage. A highly unsatisfactory rating should be given to a logistics tool that has no capability for logistics planning during pre-deployment. A satisfactory rating should be given to a logistics tool which has most of the capability required for logistics planning during pre-deployment.

43. **Employability during deployment** refers to the degree to which the software can be useful for logistics planning during the deployment stage. A highly unsatisfactory rating should be given to a logistics tool that has no capability for logistics planning during the deployment stage. A satisfactory rating should be given to a logistics tool which has most of the capability required for logistics planning during the deployment stage.

44. **Employability during employment** refers to the degree to which the software can be useful for logistics planning during the employment stage. A highly unsatisfactory rating should be given to a logistics tool that has no capability for logistics planning during the employment stage. A satisfactory rating should be given to a logistics tool which has most of the capability required for logistics planning during the employment stage.

SUMMARY OF TECHNICAL EVALUATION FINDINGS

45. The separate technical evaluations of the software systems have revealed technical strengths and weaknesses for each system. They are included in Appendix A. We can now present a comparative analysis for each group of technical criteria: benefit, cost and risk. The following comments are meant to provide a very general picture of the results observed; specific findings for each software tools are detailed in the appendix.

46. Six benefit criteria were considered in the technical evaluation. The results are presented in Figure 1. The largest difference between the scores of the two systems is for **growth potential**. Evaluators noted Planlog's flexible programming technology and shared control of forecasted growth, whereas CANLOG Planner would required a complete rewrite in order to expand its capabilities, and we had little control over its future. Both systems obtained varying degrees of dissatisfaction for data maintainability, completeness and supportability. Regarding the **data maintainability** criteria, evaluators noted the lack of mechanisms for generating and verifying the staff data used by both systems. While data updates to CANLOG Planner can only be performed by DoD programmers, Planlog has a user-friendly data edit program. For the **completeness** criteria, the limited scope of Planlog and the very limited scope of CANLOG Planner was noted. With respect to **supportability**, evaluators noted the lack of control over the continued support of each tool in their respective countries. The evaluators were ambivalent for both systems regarding the **quality of results** criteria. Results appeared reasonable, but in the case of whereas CANLOG Planner, the presentation lacked detail and the reporting format was inflexible, whereas Planlog's method of allocating transportation resources gave non-optimal results. Both systems obtained relatively high scores for **doctrinal fit**; each appearing to accommodate Canadian doctrine adequately within their limited scope of capabilities.

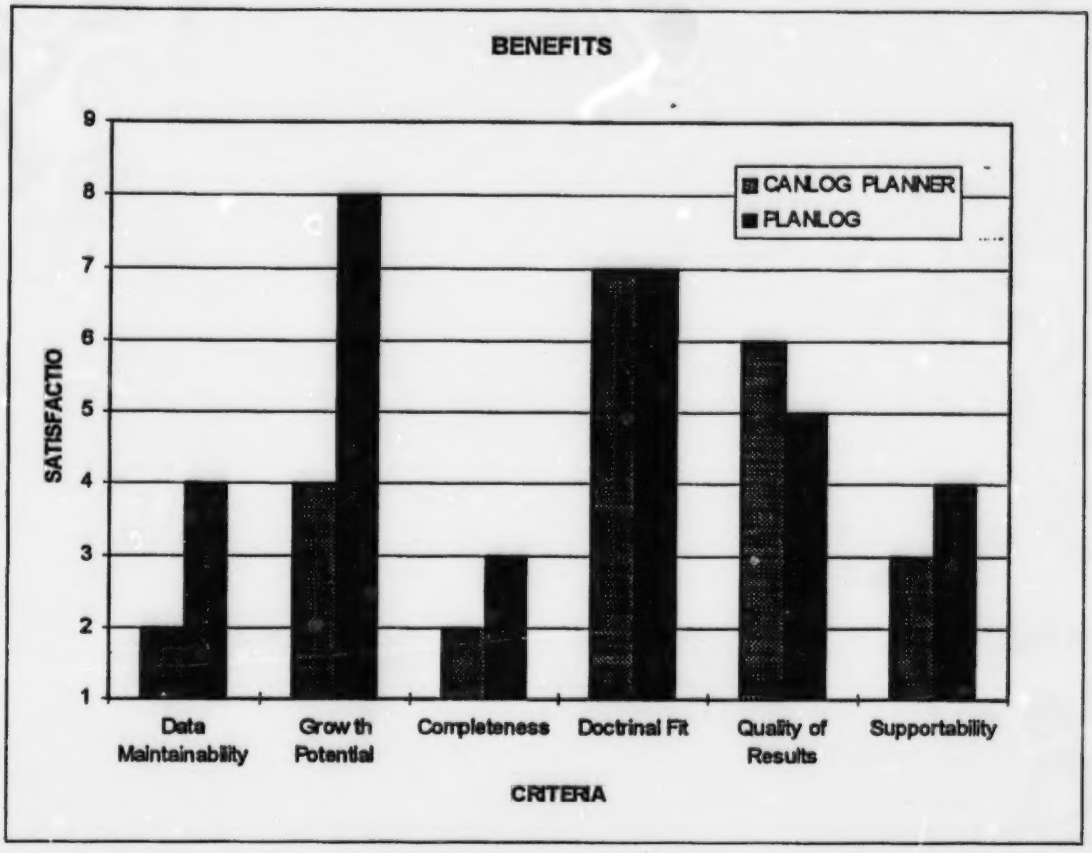

Figure 1: Satisfaction Scores for Benefit Criteria

47. The results of the evaluation of cost criteria are presented in Figure 2. All cost criteria rated fairly high for both software tools because of the expected sharing of initial and lifetime costs. The **acquisition costs** are minimal because of the co-operation agreements with the nations that initially developed the tools. The U.S. have given the tool to us while the Dutch only want scientific collaboration in return. **Development costs** are also generally satisfactory, since all CANLOG Planner developments costs and most Planlog development costs have already been spent. The evaluators were more slightly ambivalent regarding the costs of training and O&M. Both tools benefit from the potential sharing of these costs. However, CANLOG Planner is expected to incur slightly higher

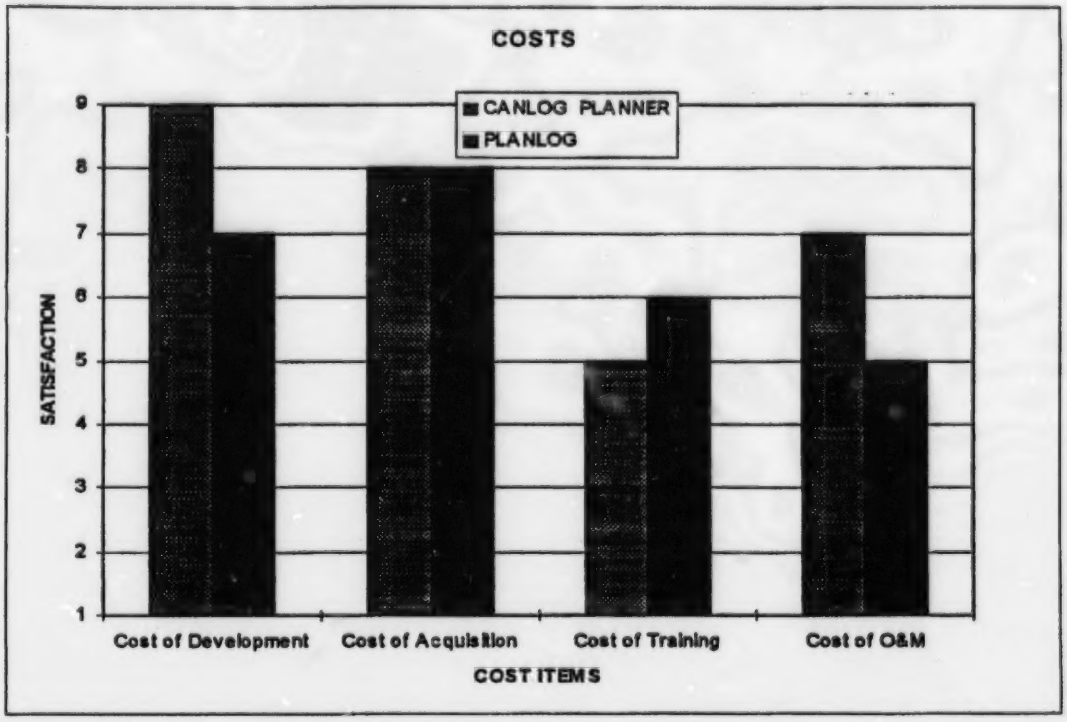

Figure 2: Satisfaction Scores for Cost Criteria

training costs because it requires greater knowledge and skill. With regards to **O&M costs**, Canada will likely be expected to participate in the further development of Planlog, while the U.S. is responsible for CANLOG Planner upgrades.

48. The results of the evaluation of risk criteria are contained in Figure 3. The risk criteria have provided the greatest differences between the two tools. In the case of the **risk of senior management support**, CANLOG Planner obtained a better score because it is already available for operational use through the Electronic Battlebox and it has the support of senior management in US DoD. However, Planlog obtained a better score for **risk of user acceptance** because of its friendly and intuitive user interface, compared to CANLOG Planner's older design/interface and its procedural dependence. Planlog also obtained a better score for **risk of obsolescence** because it was developed using a modern programming environment. Also, no other known tool duplicates Planlog's transport allocation capability.

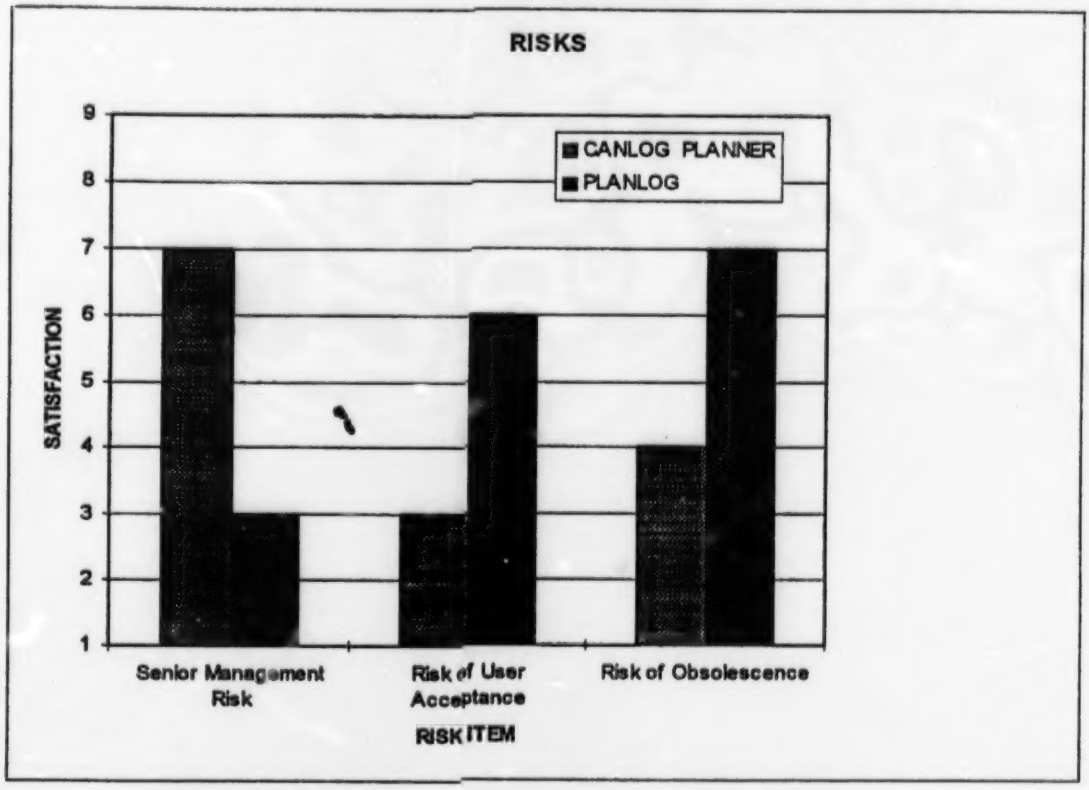

Figure 3: Satisfaction Scores for Risk Criteria

CONCLUSIONS

49. The results of the technical evaluation of CANLOG Planner and Planlog are the first part of the full evaluation of these tools. Although the results of the technical evaluation provide some important insights into the merits and weaknesses of the two tools, there are other important evaluation criteria that can only be assessed through a user evaluation. Additionally, not all evaluation criteria may be equally important. The relative importance of the various evaluation criteria has not been determined yet. It should be determined by the sponsor with input from the logistics planning stakeholders. Therefore care should be taken to avoid according undue preference to a particular tool on the basis of technical evaluation results along. Furthermore, a decision regarding the future of the two tools should not be taken without results from the user evaluation.

50. As a result of the technical evaluation it can be concluded that each tool has technical strengths and weaknesses. Without prioritising the evaluation criteria, Planlog appears to have significant technical strengths over CANLOG Planner simply due to the number of evaluation scores which favour Planlog. The technical evaluation indicates that a user evaluation of Planlog would be warranted before one on CANLOG Planner was conducted. However, since CANLOG Planner has already been released to users as part of the Canadian Land Force Electronic Battle Box (Prototype), user input can easily be solicited as well. This step could likely be accomplished using a user questionnaire.

RECOMMENDATIONS

51. It is recommended that a user evaluation on Planlog be conducted. Since CANLOG Planner has already been released to users as part of the Canadian Land Force Electronic Battle Box (Prototype), it is recommended that user input be solicited as well. This step could likely be accomplished using a user questionnaire. The results of the user evaluation and the user survey should be combined with this work to formulate final recommendations regarding Planlog and CANLOG Planner.

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ANNEX A
DOR(J&L) RN 9713
FEBRUARY 1998

CANLOG PLANNER
TECHNICAL EVALUATION

INTRODUCTION

1. CANLOG Planner is a staff data planner that performs estimates of the consumption of most classes of supply. It has been adapted from the American OPLOG Planner. CANLOG Planner employs Canadian staff data (when available) and has an adapted user interface. The rest of the tool is identical to OPLOG Planner. The program is the property of the DoD and they maintain all ownership over the product. Headquarters 1 Canadian Division (HQ 1 Can Div) has negotiated permission for DND to use a version of it. The tool was released to the army as part of the Electronic Battle Box planning tool suite in the fall of 1997.

CAPABILITIES

2. Employing a combination of user defined data and staff data, CANLOG Planner produces three types of estimates: Ammunition expenditures, POL consumption and Other classes of supply consumption. Ammunition consumption is calculated based upon the number of each type of weapon in the units employed and the intensity of the operation. POL consumption is calculated based upon the number of each type of vehicle, generator or heater and the expected employment of them. Other classes of supply consumption is calculated based upon the number of personnel deployed and the conditions they are deployed under. The estimates provided by CANLOG Planner are high level estimates which are useful for planning purposes only. The Ammunition estimate will identify the weight and the cubic dimensions of the ammunition anticipated to be consumed. This information is reported by ammunition type for each unit employed. The POL estimate provides an estimate, in litres and tons, of the consumption of each type of POL for each unit employed. The Other classes of supply report provides an estimate, in tons, of each remaining class of supply except spare parts (Class VII).

EVALUATION RESULTS

3. A technical evaluation of CANLOG Planner was conduction as part of a J4 Log sponsored project to evaluation two logistics planning tools. In accordance with the evaluation plan the tool was evaluated in fourteen categories. The tool was rated with a score between 1 (totally unacceptable) and 9 (highly satisfactory).

Cost of Development (9)

4. The development cost of CANLOG planner are negligible since all development has been completed on the current version of the tool. The US DoD has funded all development and HQ I Can Div has funded the limited programming work required to adapt OPLOG Planner to CANLOG Planner. Although CANLOG Planner could benefit from a rewrite to take advantage of newer programming techniques and an enhanced graphic interface, this work would more appropriately be considered O&M costs. The cost of development for CANLOG Planner is highly satisfactory.

Cost of Acquisition (8)

5. The acquisition costs of CANLOG Planner are negligible since the DoD has given the product to HQ 1 Can Div for use in DND. The inclusion of CANLOG Planner in the army sponsored Electronic Battle Box tool set has also minimised the distribution costs associated with the acquisition. The cost of acquisition for CANLOG Planner is satisfactory.

Cost of Training (5)

6. The implementation of CANLOG Planner as a standard tool used by staff officers in the Canadian Army will have some training costs. Because the tool lacks many of the user friendly features of current commercial software applications, it requires a greater knowledge of the tool to use it effectively. Additionally, the tool is very procedurally dependant, necessitating greater user skill. Although the tool comes with a tutorial, learning to use the tool is not trivial. For current members of the army wishing to use it, a one day training course would be advantageous. A rewritten version of the tool with an enhance tutorial, could reduce these costs. The cost of training for CANLOG Planner is neither satisfactory or unsatisfactory.

Cost of O&M (7)

7. There recurring O&M costs to date for CANLOG Planner have been minimal. DND has only been required to pay the incremental development costs associated with "Canadianizing" OPLOG Planner. The US DoD will fund any future upgrades that they deem appropriate. This arrangement is a financially favourable for CDA. Unfortunately, CDA retains little control over the future changes to CANLOG Planner. The recurring training costs for new users of CANLOG Planner are expected to be minimised as CANLOG Planner could be taught to officers at the Land Staff College. The cost of O&M is satisfactory.

Data Maintainability (2)

8. Despite the best efforts of HQ 1 Can Div developers, much of the staff data employed is a combination of invalidated Canadian data and validated (by the US) US data. The combination of these two types of data presents potential problems since the validity of these two types of data being employed together has not been verified. The process of maintaining the data employed by CANLOG Planner is very manpower intensive. DND currently has no mechanism to generate and verify the staff data used in CANLOG Planner. There is currently no commitment by senior management to develop and maintain the staff data necessary to support CANLOG Planner. Once changes to data in CANLOG Planner are identified, they can only be made by DoD programmers. This places data maintainability in jeopardy. Without maintenance of the data the tool will quickly become outdated. Data maintainability for CANLOG Planner very unsatisfactory.

Growth Potential (4)

9. CANLOG Planner has limited growth potential in its current state. CANLOG Planners original version OPLOG Planner was built using DBASE III. As a result, this tool has limited flexibility and lacks many of the user friendly features of more modern applications. The tool could likely have some "bells and whistles" added to it but they would not add significantly to the capabilities of the tool. A re-write of the tool would be a necessary first step since investing development resources in such an old database engine would be counter-productive. In order to expand the capabilities of CANLOG Planner significantly, the tool would have to be completely re-engineered. The growth potential for CANLOG Planner is mildly unsatisfactory.

Completeness (2)

10. CANLOG Planner performs one step in the logistics planning and execution process very well. CANLOG Planner performs a staff check of material consumption and provides its results in a very aggregated fashion. The information for POL and ammunition is useful to planners as it is presented by CANLOG Planner but all other supply information requires more definition if it is to be used for more than rough lift estimates. CANLOG Planner provides no capability to perform all of the other steps in the logistics planning and execution process. The limited scope of this tool makes it an inadequate logistics planning and execution tool by itself. This tool would more suitable be employed a part of a suite of logistics tools. The completeness of CANLOG Planner is very unsatisfactory.

Doctrinal Fit (7)

11. CANLOG Planner accommodates Canadian doctrine adequately within its limited scope of capabilities. Material consumption rates are adjusted to accommodate operational tempo as Canadian doctrine dictates. The doctrinal fit of CANLOG planner is satisfactory.

Quality of Results (6)

12. Limited testing of the tool revealed the results to be consistent. Based upon the staff data employed, the tools accuracy was very good. For some classes of supply, the results lacked detail. The presentation of results by the tool was inflexible and not in a form that would be useful for other logistics tools. With more use of the tools in non-operational situations the quality of the results can be validated and improved upon. The quality of results for CANLOG Planner is mildly satisfactory.

Supportability (3)

13. CANLOG Planner is essentially a DoD product adapted for Canadian use. CANLOG Planner is a version of OPLOG Planner which employs Canadian data (where available) and has an adapted user interface. Therefore CANLOG Planners supportability is directly tied to that of OPLOG Planner. Although DoD currently supports their tool very well, there is great

uncertainty regarding supportability of CANLOG Planner since DND has no control over it. The supportability of CANLOG planner is unsatisfactory.

Risk of Senior Management Support (7)

14. OPLOG Planner is a well accepted tool in DoD. It is employed for operational planning and to generate consumption forecasts for budget submissions. As a result it is likely that senior management will accept CANLOG Planner if the major deficiencies identified with the tool can be overcome. The fact that the army has included CANLOG planner in their Electronic Battle Box enhances the tools chances of senior management acceptance. The risk of senior management acceptance of CANLOG Planner is satisfactory.

Risk of User Acceptance (3)

15. CANLOG Planner has a significant risk that users will not accept it. Due to the old design and user interface, users will quickly question the value of using this relatively unfriendly tool. Additionally, the tool is currently very procedurally dependant making it difficult to learn and use. Conversely, users may tolerate these inadequacies so that they have "something" to help them in their work. If CANLOG Planner remains in its current state, it will likely be accepted by users only until something better is made available. The risk of user acceptance of CANLOG Planner is unsatisfactory.

Risk of Obsolescence (4)

16. The risk of obsolescence is significant for CANLOG Planner. The tool is "old technology" therefore it is a prime candidate to be rendered obsolete. Additionally there are other software initiatives (Planlog, CFSS Upgrade, MIMS, etc) which could duplicate CANLOG Planners capabilities to some extent. The fact that there is no replacement of CANLOG Planner immediately visible does not reduce the risk of obsolescence in the next few years. The risk of obsolescence for CANLOG planner is mildly unsatisfactory.

ANNEX B
DOR(J&L) RN 9713
FEBRUARY 1998

PLANLOG
TECHNICAL EVALUATION

BACKGROUND

1. Planlog is a logistics planning tool developed by the Dutch research organisation TNO for the Dutch army. This program is at the prototype stage. It was built in Powerbuilder and uses the Paradox database access software. Planlog came to our attention through a review of potential candidates for a Dutch-Canadian collaboration program. It was one of the tools which could potentially fill a Canadian requirement in logistics software.

CAPABILITIES

2. Planlog estimates consumption of Class I, III and V goods for operational units and for the logistics units supplying them. The units and routes can be drawn over a bitmap representation of the theatre of operation. Planlog rolls up consumption rates as per staff tables, applying intensity factors depending on the activity, the type of terrain and the weather. Planlog also allocates transportation means using a linear optimisation solver. Although the original Dutch version allocated transportation means by class, TNO produced for us a version which allocates transportation means by subclass. The subclasses were created to ensure compatibility of goods for transportation. This made the number of variables in the optimisation model too large for a mixed integer solver, so the problem was relaxed to searching for an optimal non-integer allocation of transportation means, then rounding off to an integer allocation. The solution found in the tested version is then not necessarily optimal. For moderately complex scenarios, the solver was still too slow, so TNO improved the version by setting a variable time limit on the solver. With this version, we can perform exploratory analysis with a short time limit, and also find solutions closer to optimal by setting a longer time limit. TNO has been very responsive to our needs.

EVALUATION RESULTS

3. A technical evaluation of Planlog was conducted. The fourteen criteria listed in the evaluation plan were used to generate scores between 1 (highly unsatisfactory) to 9 (highly satisfactory).

Cost of development (7)

4. To date, the development of Planlog has been done by TNO, sponsored by the Dutch Army. The last step is to improve the prototype into a fully operational system. Under the Dutch-Canadian collaboration agreement, this could be completed with Canadian assistance. This would enable obtaining the necessary expertise to build a Canadian version. The cost of development could be significant, but not as prohibitive as building a system from scratch. It could easily be within a reasonable budget level. The cost of development for Planlog is satisfactory.

Cost of Acquisition (8)

5. The acquisition cost would be minimal since the software system could be obtained through the Dutch-Canadian collaboration program. There are no unusual hardware requirements, so existing computers could be used. The cost of acquisition is very satisfactory.

Cost of training(6)

6. The Planlog user interface is very easy to understand and use. It uses standard features of Windows-type software. In order to implement it as a standard tool for logistics staff officers, minimal initial training is required. However, the current training materiel is in the Dutch language and would have to be translated. Again, this may be significant, but not as much as starting from scratch. The cost of training is mildly satisfactory.

Cost of O&M (5)

7. Canada would be participating in Planlog's lifetime development, so that a Canadian version could be slightly different from the Dutch version. Expertise in the models could be held in both nations, facilitating the sharing of improvements made to either version. Planlog was built using a standard program development software and could be updated easily. Cost of O&M could then be significant, but not prohibitive. The cost of O&M is neither satisfactory nor unsatisfactory.

Data maintainability(4)

8. The database in Planlog is managed by a separate data editor, whose functions resemble standard database management systems. Updating data is therefore technically feasible without a significant amount of effort. However, consumption figures are taken from staff tables, for which no current mechanisms exist for generating or verifying them. Therefore, updating data could be done with relative difficulty. The maintainability of Planlog is mildly unsatisfactory.

Growth potential(8)

9. The prototype was built using Powerbuilder, a standard program development software. This means that the tool can be easily modified to accommodate capability growth. The graphical component of the tool is very basic and leaves room for improvement as does the reporting system. Planlog currently uses the ReportSmith report generating tool to create very basic pre-defined reports. The reports take a long time to produce and present sketchy information. Both the graphical component and the reporting capabilities could be improved with a reasonable amount of effort. There is also growth potential for the tool in the area of detailed task planning for transportation. Being a partner in the development of Planlog, Canada could influence the development in one of these directions. The growth potential of Planlog is very satisfactory.

Completeness(3)

10. Planlog calculates Classes I, III and V consumption and based on basic geographical information, allocates transportation resources to deliver the material. Because Planlog only deals with three classes of supply and it does not perform other logistics planning tasks, it is by no means a complete logistics planning system. For that reason, the completeness of Planlog is unsatisfactory.

Doctrinal Fit(7)

11. Planlog appears to accommodate Canadian doctrine adequately. It can model the exchange of commodities at delivery points. The doctrinal fit for Planlog is satisfactory.

Quality of results(5)

12. Consumption results appeared to be reasonable, the few anomalies noted were the result of inaccurately input data. Intensity factors for activity, weather and terrain are based on Dutch staff tables and have not been validated for Canadian use. The allocation of transportation resources was more problematic. The rounding of continuous linear programming solutions causes non-optimal solutions, although they are considered near-optimal. This could be resolved with the Planlog version which uses an integer programming method, but at a cost of an unreasonable amount of computing time. This is viewed as a key result which is inaccurately derived. The quality of results for Planlog are neither satisfactory nor unsatisfactory.

Supportability(4)

13. The developer of Planlog is TNO in the Netherlands, and is not readily accessible by users. Both language and distance complicate the supportability of Planlog. Canadian expertise will have to be built up. Also, the Dutch version of Planlog has not yet been accepted as an operational logistics planning tool. Developer support would probably be impossible to obtain if Planlog was rejected in the NL. In this case, it would logically be rejected in Canada. The supportability for Planlog is mildly unsatisfactory.

Risk of senior management support(3)

14. Planlog has not been fielded with the Dutch army yet. Senior management have not had the opportunity to accept or reject the tool. Since Planlog has not yet been accepted by any senior management, the risk of senior management support is unsatisfactory.

Risk of User Acceptance(6)

15. Planlog is an easy-to-use tool which has a visually pleasing data interface. The problem with the feasibility/optimality of results would preclude user acceptance. This would need to be solved. Planlog has not been fielded yet so users have not had an opportunity to accept or reject the tool. However, assuming that technical problems with the optimiser can be resolved, it is likely that Planlog will be accepted by its users. The risk of user acceptance for Planlog is mildly satisfactory.

Risk of Obsolescence(7)

16. Planlog was built using a standard software development package, which is not likely to become obsolete in the near term. Its user interface includes standard Windows-type features which are not likely to be replaced in the near future. There are other software tools which can duplicate the generation of consumption figures, but there is no other known tool which optimally allocates transportation resources. The risk of obsolescence for Planlog is satisfactory.

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1. ORIGINATOR (the name and address of the organization preparing the document. Organizations for whom the document was prepared e.g. Establishment Sponsoring a contractor's report, or tasking agency, are entered in Section 8).

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3. TITLE (the complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title)

An Evaluation of Logistics Planning Tools

4. AUTHORS (last name, first name, middle initial)

Vigneault, M.; and Maj Hoyle, Doug

5. DATE OF PUBLICATION (month Year of Publication of document)

February 1998

6a. NO OF PAGES (total containing information. Include Annexes, Appendices, etc.)

33

6b. NO OF REFS (total cited in document)

4

7. DESCRIPTIVE NOTES (the category of document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of report e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)

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8. SPONSORING ACTIVITY (the name of the department project office or laboratory sponsoring the research and development. Include the address).

J4 Log

9a. PROJECT OR GRANT NO. (if appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.)

3561-LDO-G

9b. CONTRACT NO. (if appropriate, the applicable number under which the document was written.)

10a. ORIGINATOR's document number (the official document number by which the document is identified by the originating activity. This number must be unique to this document.)

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In March 1997, J4 Log tasked LOGORT to conduct an evaluation of two software systems being considered as potential logistics planning tools for the Canadian Forces. This paper presents a multi-criteria methodology for evaluating logistics planning software. It proposes a list of criteria to be considered through a two-stage process involving first a technical evaluation and secondly a user trial. During each step, a subset of criteria are evaluated using the judgements of evaluators, in order to produce importance and satisfaction ratings. This report presents results of the technical evaluation and makes recommendations concerning a user trial.

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